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(54) Catheter with internal stiffening ridges

(57) This invention relates to a catheter comprising a tube-like basic body which is formed by a first tube-like element with a lumen bounded by a lumen wall and at least a second tube-like element which has been received in the lumen and comprises an outer wall. Of the outer wall and the lumen wall at least one has been provided with a number ridges substantially extending in the longitudinal direction of the basic body.

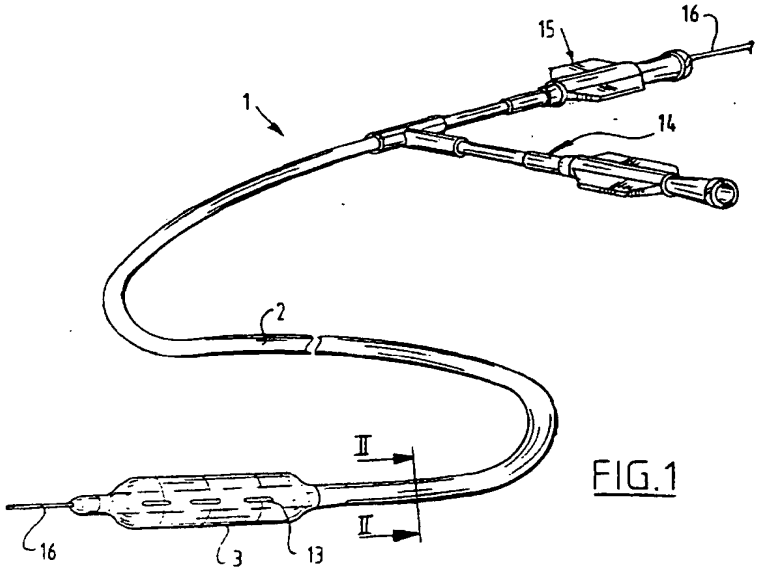

FIG.1

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Description

The invention relates to a catheter comprising a tube-like basic body. The tube-like basic body has been formed by a first tube-like element comprising a lumen which is bounded by a lumen wall and by at least a second tube-like element which has been received in the lumen and has an outer wall.

Such a catheter is known. The construction with a second tube-like element received in a lumen of a first tube-like element is in particular employed to obtain catheters with small diameters. The annular space in between the lumen wall of the first tube-like element and the outer wall of the second tube-like element forms a lumen through which a fluid can be transported from one end of the basic body to the other. In the second tube-like element there may also be a lumen, which may function as for instance a guide wire lumen. The advantage of the known catheter is a relatively large effective sectional area of the lumens.

A drawback of the known catheter is that it is susceptible to buckling. Especially when limited wall-thicknesses are employed in order to achieve as large as possible effective cross-sections of the lumens, this danger is very much present.

The object of the invention is to provide a catheter of the type as described in the preamble which is not or only to a limited degree susceptible to buckling. With the catheter according to the invention this aim is achieved with the measures as characterised in claim 1. The ridges reinforce in the first place the tube-like element on which they have been arranged, so that it does not buckle so easily. In addition, when bending the catheter the ridges may rest against the other tube-like element, which furthermore reduces the chance of buckling of the tube-like element onto which the ridges have been arranged. Thirdly, also the tube-like element which itself has not been provided with ridges, but is positioned against the ridges of the other tube-like element, becomes less prone to buckling due to the support provided in this manner. The basic body of the catheter according to the invention has consequently a very considerable buckling resistance.

By employing the measure as set out in claim 2 a simple construction of the basic body is possible. The second tube-like element may be pushed inside the first tube-like element and does not need to be fixed inside it. The favourable mutual influence of the buckling behaviour of the separate tube-like elements is also achieved in this case, as, because of the flattening deformation of the tube-like elements, a good contact is achieved between the ridges and the opposite wall on bending.

An advantageous further development has been characterised in claim 3. The top-surface supports the opposite wall evenly over its entire surface area, without concentrations of stress occurring which expedite buckling.

A high buckling resistance is achieved with the measures as set out in claim 4.

A suitable embodiment, which is also suitable for small to very small catheter-diameters, has additionally been characterised in claim 5.

In order to prevent a preferred bending direction of the basic body, the measure as set out in claim 6 is preferably employed.

The invention will be explained in greater detail in the following description with reference to the attached drawings.

Figure 1 shows a perspective view of a balloon catheter according to the invention.

Figure 2 shows a cross-section along the line II-II of figure 1.

A balloon catheter 1 illustrated in figure 1 comprises a tube-like basic body 2 at a distal end of which a balloon member 3 has been arranged. The proximal end of the basic body 2 has been connected to connecting members 14, 15, the functions of which will be explained in greater detail below.

As can be seen in figure 2, the basic body 2 has been formed by a first tube-like element 5 with a lumen 12 which is bounded by a lumen wall 7. A second tube-like element 6 has been received inside the lumen 12, which itself comprises a lumen 11.

With this example of an embodiment the outer wall 8 of the second tube-like element 6 has been provided with ridges 9 which extend in the longitudinal direction of the basic body 2. The ridges 9 reinforce the second tube-like element 6 to such an extent that it tends to buckle less easily.

On bending the basic body 2 rather sharply, the lumen wall 7 will be positioned against the top-surfaces 10 of the ridges 9 due to a flattening of the cross-section of the first tube-like element 5. On the one hand the second tube-like element 6 is supported as a result, so that it can be bent more sharply before it buckles. On the other hand also the first tube-like element 5 is supported internally by the ridges 9, so that also this first tube-like element 5 buckles less quickly. The result of these effects is that the basic body 2 of the catheter 1 displays a significant resistance to buckling.

As can be seen in figure 2, the top-surfaces 10 of the ridges 9 are substantially concentric with the tube-like element 6 and consequently also with the tube-like element 5, so that these top-surfaces 10 make contact with the lumen wall 7 in an even fashion. Consequently, on making contact no concentrations of stress will occur in the wall of the first tube-like element 5, which is favourable in order to prevent buckling.

The function of the central lumen 11 in the second tube-like element 6 of catheter 1 is to accommodate a guide wire 16.

As is known, first a guide wire is introduced into a patient after which a catheter such as the catheter 1 is passed over the guide wire 16 into the body of the patient, until the balloon member 3 has arrived in the target position. The second tube-like element 6 extends

over the entire length of the catheter and the lumen 11 thereof is accessible via the connecting member 15 at the proximal end.

The remaining space of the lumen 12 of the first tube-like element 5 has been made accessible via a connecting member 14 of which a channel is connected to this lumen 12 via an opening in the wall of the first tube-like element 5. At the distal end a number of openings 13 have been arranged in the wall of the first tube-like element 5 at the site of the balloon member 3, so that the lumen 12 is connected with the inside of the balloon member 3 via these openings 13. By introducing fluid under pressure into the balloon member 3 via the connecting member 14, this balloon member 3 may be expanded in order to carry out for instance angioplasty.

Although in the embodiment illustrated the ridges 9 have been arranged on the outer wall of the second, inner tube-like element 6, it is also possible to provide the first, outer tube-like element 5 on the inside, on the lumen wall 7, with ridges. These ridges will reinforce in that case the first tube-like element, and due to the cooperation with the second tube-like element as described above, the resistance to buckling of the entire basic body 2 is furthermore increased.

In a suitable manner the number of ridges 9 is three, and the ridges have been arranged evenly distributed around the circumference. Other quantities of ridges are possible as well however.

In this way many variations of the inventive idea are possible. All these variations are considered to fall within the scope of the attached claims.

Claims

1. Catheter comprising a tube-like basic body which is formed by a first tube-like element with a lumen which is bounded by a lumen wall and at least a second tube-like element which has been received in the lumen and comprises an outer wall, wherein of the outer wall and the lumen wall at least one has been provided with a number of ridges substantially extending in the longitudinal direction of the basic body.

2. Catheter as claimed in claim 1, wherein the second tube-like element has been received in the lumen of the first tube-like element in a loose manner.

3. Catheter as claimed in claim 1, wherein the ridges have a top-surface which is substantially concentric with the tube-like element carrying the ridges.

4. Catheter as claimed in claim 1, wherein the number of ridges is uneven and the ridges have been arranged evenly distributed around the circumference.

5. Catheter as claimed in claim 4, wherein the number of ridges is three.

6. Catheter as claimed in claim 1, wherein the ridges extend in a helical pattern.

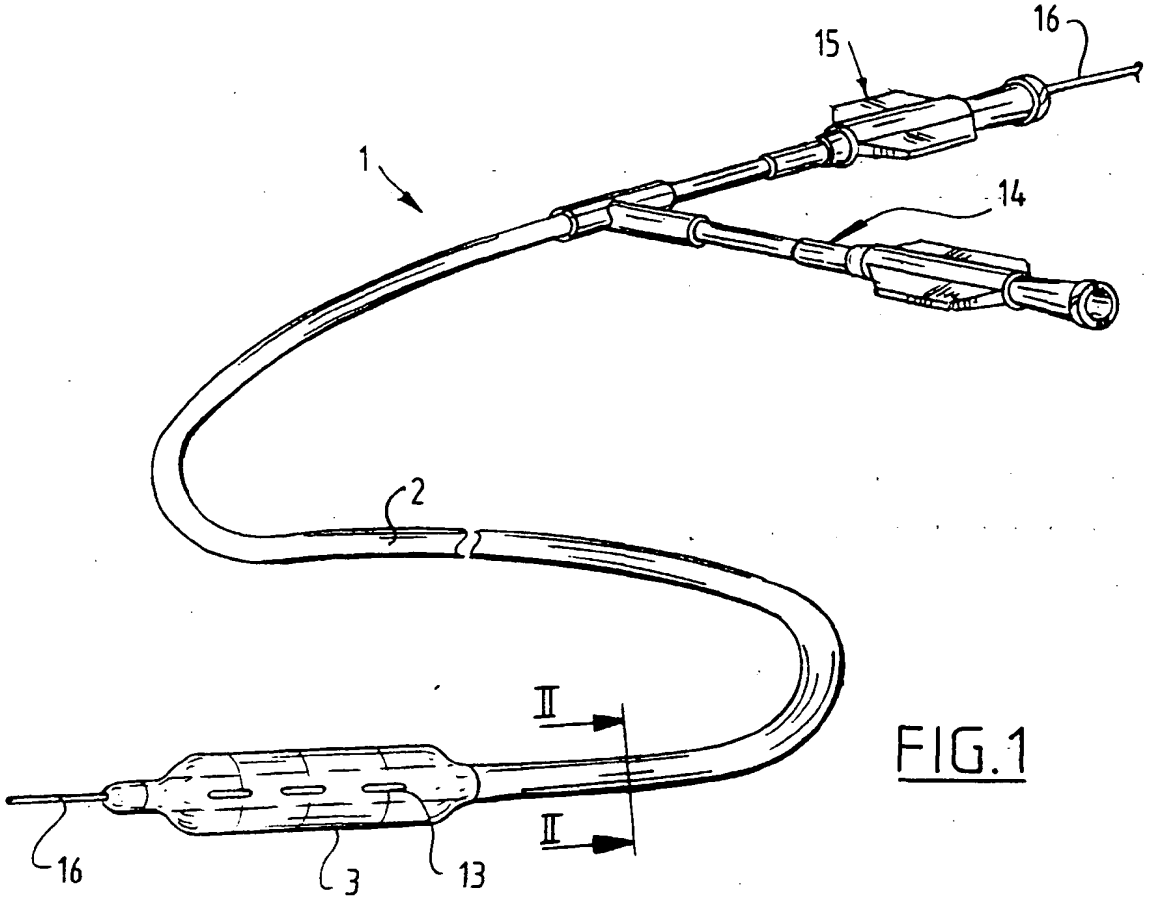

FIG.1

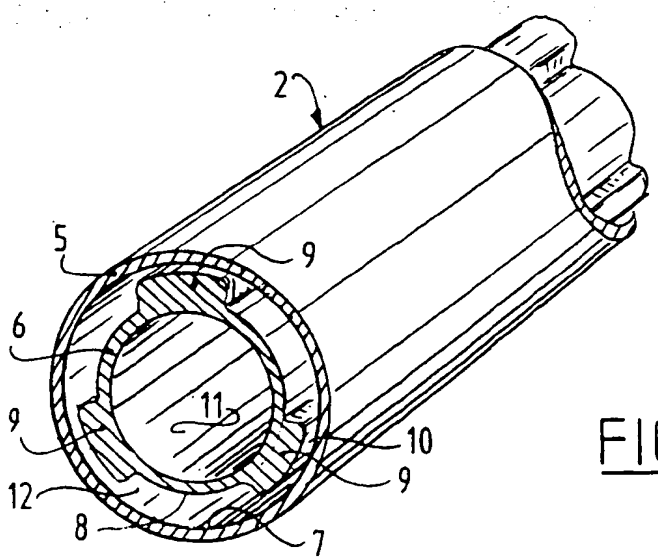

FIG.2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 20 2763

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	DE 28 20 239 A (OLYMPUS OPTICAL) 16 November 1978 * page 8, paragraph 2 - page 9, paragraph 3; figures 4-10 *	1-3	A61M25/00
X	WO 86 00232 A (EKHOLMER) 16 January 1986 * the whole document *	1,3	
A	DE 41 13 265 A (BAUERFEIND) 12 March 1992 * claim 1; figures *	1,2	
A	WO 93 08864 A (MYERS) 13 May 1993 * page 14, line 6 - page 15, line 17; figures 13-34 *	1,4-6	
A	EP 0 454 264 A (ASHRIDGE) 30 October 1991 * column 1, line 34 - line 53; figures *	1,3-5	
P,X	US 5 593 394 A (KANESAKA) * column 3, line 1 - line 10; figure 3 *	1-3	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

A61M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	27 November 1997	Kousouretas, I

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